5. On Hybrids between Salmon and Trout.

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The hybridism of fishes is a question of very great interest to the zoologist and importance to the pisciculturist, but which, for obvious reasons, is difficult to investigate, it being only those who possess large stock-ponds or peculiarly adapted waters that are able to assist inquirers in this direction or personally afford the desired information.

Among the Salmonidæ hybrids have frequently been adverted to as occurring in a state of nature, as well as due to the manipulations of pisciculturists. Fitzinger informs us that *Salmo schiffermuelleri* must be considered a cross between a Trout and a Charr, and that in the young the reproductive organs merely exist in a rudimentary condition, while they degenerate into adipose tissue in the adult.

At Sir J. Gibson-Maitland's magnificent piscicultural establishment at Howietoun near Stirling some experiments on this subject have been made, at first under the impression that all our freshwater forms of Trout were distinct species; while others are now in progress, the results of which will be watched with great interest.

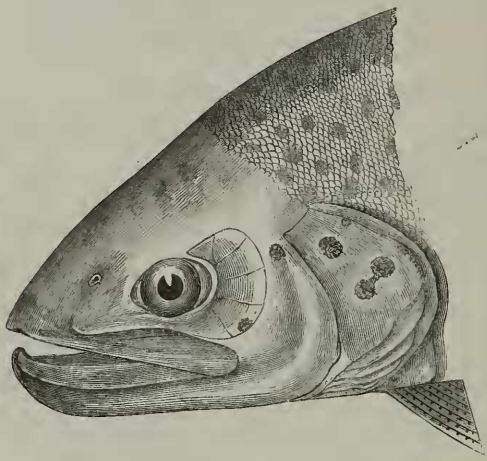
November 25th, 1879, a man arrived at Howietoun with some salmon-milt obtained the previous night; and this was employed for the purpose of fertilizing some eggs from a four-year-old Lochleven Trout. A few of the progeny were successfully reared; and one of the last examples was captured in the stock-ponds in my presence, November 14th, 1882. It was given me by the owner, and is now on the table. The age of the fish is consequently about 2 years and 9 months, being in fact a grilse in good condition and 11 inches in length.

B. x. D. 12 ($\frac{2}{9}$). P. 12–13. V. 9. A. 11 ($\frac{3}{8}$). C. 19.
L. l. 118. L. tr. 25/30. Cæc. pyl. 62.

	inches.
Total length of specimen	11·0
Length of head	2·4
Length of pectoral fin	1·7
Distance from snout to base of dorsal fin	4·5
Distance to centre of base of caudal	9·8
Diameter of eye	0·4
Distance of eye from end of snout	0·7
Distance apart	0·8
Height of body	2·5

Preopercle forming an almost regular curve, with but very slight appearance of a lower limb. Lower jaw with a slight hook at its extremity. A line taken from the snout to the furthest point of the posterior edge of the opercle passes through the lower third of the eye. Teeth in a double row along the body of the vomer. *Scales*: 12 rows passing downwards and forwards from the hind edge of the adipose dorsal fin to the lateral line; 25 rows

from the lateral line to the base of the ventral fin. Row of scales on the upper half of the body very irregular. *Colour*: On removal from the water it was silvery with a rich purple gloss, from 7 to 8 irregularly placed rows of black spots were present on the fore part of the body, gradually decreasing in number to 3 or even 2 in the caudal portion; no parr marks on the sides, 4 large black spots on the opercle and 2 more on the cheeks. Fins greyish, darkest in



Head of Hybrid Salmon (Tay), ♂.

the centre, the dorsal with black spots and a white anterior edge. Testicles present but rudimentary, no milt being present.

December 24th, 1881, about 20,000 eggs of Lochleven Trout were fertilized with salmon-milt; they hatched on March 9th, 1882, or in 75 days. Of these, on November 15th about 1250 were alive at Howietoun. The largest example was $4\frac{1}{2}$ inches in length, and four of these fish are on the table.

B. x. D. 13 ($\frac{3}{10}$). P. 13–14. V. 9. A. 11 ($\frac{3}{8}$). C. 19.
L. l. 116–118. L. tr. 25–26/30–32. Cæc. pyl. 61–78.

	No. 1.	No. 2.	No. 3.	No. 4.
Length of example	4·3	3·4	4·1	4·0
Length of head	0·9	0·7	0·8	0·8
Length of pectoral fin	0·8	0·6	0·6	0·6
Length from snout to base of dorsal	1·7	1·4	1·7	1·6
Length from snout to base of caudal	3·8	3·0	3·6	3·4
Diameter of eye	0·2	0·15	0·2	0·2
From end of snout	0·25	0·2	0·2	0·23
Apart	0·3	0·27	0·3	0·3
Height of body	0·8	0·65	0·7	0·7

In example No. 1 the length of the central caudal ray is half that

of the longest outer one. The maxilla extends posteriorly to beneath the posterior third of the eye. The preopercle has a distinctly oblique lower limb, which in this example is less strongly marked than in No. 2, while merely a simple curve exists in Nos. 3 and 4.

The central caudal ray is half the length of the longest outer one in examples 1 and 2, but two thirds in Nos. 3 and 4. Respecting the cæcal appendages, Nos. 3 and 4 were first immersed in a weak solution of chromic acid, which has hardened them, facilitating their being counted. No. 3 contained 78, and No. 4 had 61; the other two were not examined. If hybrids between the Lochleven Trout and a male Salmon show such variations, it demonstrates the inconstancy of the number of these appendages. We took two Lochleven Trout, each similar in appearance, and about 8 inches in length, which had been bred at Howietoun from eggs and milt of fish inhabiting the stock-ponds, and were consequently one generation removed from Lochleven parentage; in one they were short and 40 in number, in the other rather long and 67. (The preparations are on the table.)

Respecting the scales, from 120 to 121 rows descend from the back to the lateral line. In Nos. 1, 3, and 4 there are 13 passing downwards and forwards from the hind edge of the base of the adipose dorsal fin to the lateral line, while in No. 2 there are 12.

Colours. These are nearly identical in all four; from 12 to 13 lateral parr bands pass down the sides, which are also more or less closely sprinkled with small black spots and some few red ones; there are also black spots on the gill-covers and on the upper surface of the head. A very remarkable feature common to all is that the dorsal fin has its front upper edge white, with a black intramarginal band, and from 11 to 13 black spots on or between the rays. Attention may here be directed to no white upper edging existing on the dorsal fin in any of the Lochleven variety of Trout at Howietoun, such a mode of colour being restricted to the burn-trout variety at that establishment; and this forms another link in the chain of facts that these two forms are merely varieties of one species.

I wish here to record some experiments commenced on November 15th by Sir J. Gibson-Maitland, while I and others were present.

About 3000 ova were obtained from Lochleven Trout, and fertilized with the milt of the American Charr, *Salmo fontinalis*. They were placed in hatching-box No. 108.

About 8000 ova of the American Charr were milted from Lochleven Trout, and placed in hatching-box No. 104.

About 9000 ova of the American Charr were fertilized with the milt of a Scotch Charr which has been termed *Salmo struanensis*, and placed in hatching-box No. 115.

In Austria, observes Peyrer, the Charr (*Salmo salvelinus*) is crossed with the Trout; and the young excel the pure breed in many respects. Whether this is partly due to their being sterile, and consequently not going out of season subsequently to the breeding-season, is not mentioned. The life-history of these true hybrids cannot but be interesting; and such in due time will doubtless be forthcoming from Howietoun.